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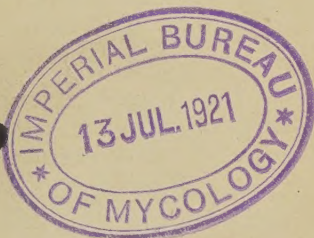
MAY, 1909

BULLETIN 266

CORNELL UNIVERSITY
AGRICULTURAL EXPERIMENT STATION OF
THE COLLEGE OF AGRICULTURE
Departments of Horticulture and Plant Pathology

THE BLACK ROT OF THE GRAPE
AND ITS CONTROL

Second Report



By C. S. WILSON AND DONALD REDDICK

ITHACA, N. Y.
PUBLISHED BY THE UNIVERSITY

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The regular bulletins of the Station are sent free to persons residing in New York State who request them.

THE BLACK ROT OF THE GRAPE AND ITS CONTROL

Second Report

Generally speaking, the vineyards of New York have experienced two successive years of relative immunity from the Black Rot disease, the greatest scourge with which they have to contend at the present time. During both the seasons 1907 and 1908, however, there have been certain localities in which the disease has been destructive, and in no case, so far as the writers have observed, have any of the larger growing sections been entirely free from it. Even in well-kept vineyards in the heart of the Chautauqua Belt, the grape section most free from Black Rot, occasional berries attacked by the Black Rot fungus have been found. It is only commercially that we may say there has been no Black Rot the past two seasons. This is of particular importance as regards future operations and future epidemics of the disease, especially when taken in connection with a survey of past experience with the parasitic fungus.

EXPERIENCE IN FRANCE

Since its introduction into France in 1885, Black Rot stands second only to the Phylloxera and Mildew in its destructiveness in the more humid valleys of France and other humid grape-growing regions of all Europe. In many of the regions, and particularly in Central and Southern France, the people are largely dependent on the product of the vine for their maintenance. For this reason they have been especially alert in the fight against Black Rot, and French literature abounds in observations and experiences regarding the control of the disease. A critical examination of this literature shows that in France the Black Rot fungus has had ups and downs, and has been epidemic and of very serious nature only in certain years. Fortunately, very complete meteorological data are available and positive correlation between the amount of rainfall during the growing season and the abundance or scarcity of Black Rot has been established. It shows further that after a succession of years relatively free from Rot many of the vineyardists became lax in their spraying operations only to be visited by another epidemic of the disease in exceptionally wet seasons. It cannot be expected that the vineyards of New York will prove any exception to this rule, and from the fact that Black Rot is actually present to a slight extent in most vineyards it would seem that an exceptionally

wet season, or succession of such seasons, is the only condition necessary to bring about another epidemic of the disease.

LIFE HISTORY OF THE FUNGUS

(*Guignardia bidwellii*.)

This opinion bears more weight when certain facts in regard to the life habits of the fungus are considered. In 1908, the writers published a bulletin from this Station which, among other things, contained a statement of the known facts in regard to the method of conservation, propagation, and dissemination of the fungus. Epitomizing briefly it may be stated that the specific cause of the Black Rot disease is a microscopic fungous parasite (*Guignardia bidwellii* (E) V. & R.). The fungus passes the winter on the old mummied berries, either clinging to wires or lying on the surface of the ground; on the clinging tendrils or leaf petioles; and on the canes bearing the fruit-buds (Fig. 99). The fungus on such parts perishes when covered by a few inches of soil, but it is obviously impossible to treat the canes in such a manner and impracticable to remove tendrils from the wires.



FIG. 99.—Black Rot lesions on one-year-old cane. The minute black pimples are fruiting bodies of the fungus in which spores may live over winter

The spores, or reproductive bodies of the fungus, are encased and protected in a receptacle which prevents their being killed by a contact spray. Spores are discharged by a purely mechanical process requiring the presence of precipitated moisture. The water is absorbed by a gelatinous substance surrounding the spores and by the swelling of this substance the spores are mechanically forced from the receptacle. Under natural conditions this happens only when there is a rain of sufficient duration to thoroughly moisten the parts bearing fungous receptacles. The spores thus discharged must be borne by the wind or spattered by a breaking drop of water to some green and growing part of the vine in order to be able to produce an infection, and, even then, such an infection is possible only when the spore has the necessary moisture for a sufficient time to permit of germination. It was found further that, after the entrance of the germ tube of the spore, at least ten and often as many as twenty days are necessary

for incubation of the fungus before characteristic spots appear. Stages in the rotting of berries, from the appearance of a spot, through the bird's eye and brown rot stage to the final shriveling and blackening of the berry, are shown in Fig. 100.¹

During the early part of the season of 1907 we were able to check up the correlation between rainfall and the subsequent sudden appearance of Black Rot all over the vineyard, and also found that after July 12th during a period of comparative drought no new Rot appeared, although spores were present in very great abundance and capable of germination by actual test.

In spite of the exceptionally dry season of 1907, Black Rot was very destructive in an unsprayed vineyard of 200 acres only 2 miles from the site of our operations. Our experimental work for 1908 was therefore moved to this vineyard. One of the writers was constantly on the



FIG. 100.—Successive stages of Black Rot lesions on berries. A berry passes through these stages in three or four days

ground after June 1st. Besides continuing studies on the life history of the fungus, careful watch was kept on local weather conditions, for we were firmly convinced that in order to be effective, spray must be applied to the actively growing parts before the rains came. It seemed apparent from earlier observations, as well as the experience of other investigators, that spray mixture properly made and properly applied, if given an hour or more to "set," will prevent the entrance of fungi even after a continued rain of 24 hours or more. If then from a study of the available weather data and of local conditions we could predict with some degree of certainty the storm periods and make a thorough application of spray one to three days before these came, we should be able to prevent the Rot entirely.

How well we succeeded in our predictions may be seen by a comparison of the dates on which we sprayed and the meteorological data on another page. It will be noticed that the spraying of June 11th followed the rains of June 9th. In this connection it should be stated that all things were in readiness to begin spraying on the morning of June 9th and by 4 p. m. (the time of beginning of precipitation) the whole plat would

¹ Bulletin 253 "The Black Rot of the Grape and Its Control," containing a more detailed account of the fungus and illustrations of the fruiting parts, is still available and may be obtained by applying to the College of Agriculture, Ithaca, N. Y.

have been sprayed had not an unexpected break in machinery occurred which could not be remedied until too late. From this rain infections appeared on all the plats to a certain extent. But the spray of June 15th, preceding the continued rains of June 22nd, 23rd, 24th, gave absolute protection against the infections which took place on these dates, and which appeared on the berries just at noon on the three days July 3rd, 4th and 5th, the period of incubation being just ten days in each case. An extended and critical examination of the experimental plats was made at this time. Only a single berry was found on sprayed

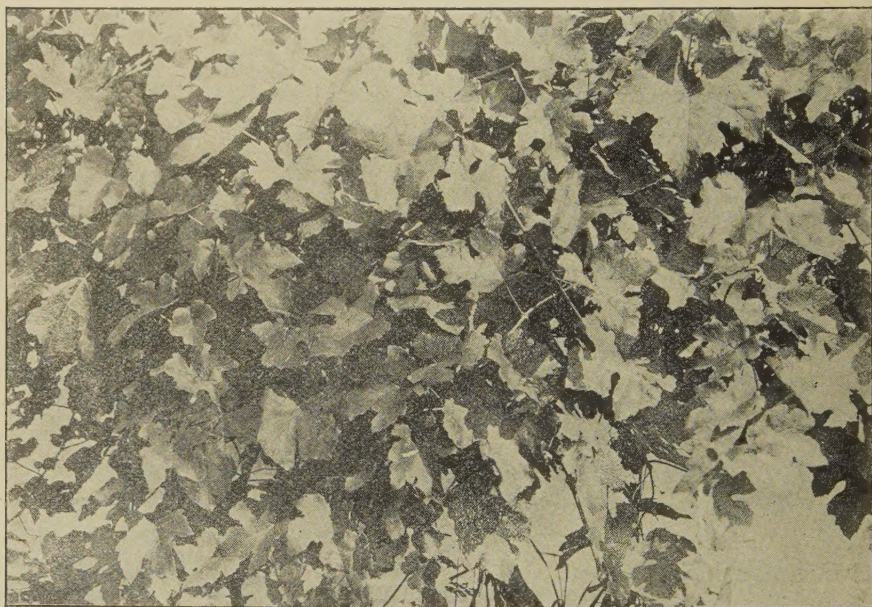


Photo. Aug. 31, 1908

FIG. 101.—View of a vine in Experimental Plat No. 4 from the windward side. This shows the difficulty of attempting to spray with stationary nozzles. See photograph of same vine with leaves stripped on opposite page

plats which had become infected. Unsprayed check rows showed a quantity of Rot while the check plat and all the remainder of the vineyard showed Rot in very great quantities.

When even a relatively small amount of Rot appeared in the sprayed plats, it made future sprayings more imperative since opportunities for infection were so much greater. By this time, too, physical conditions made thorough spraying more difficult. A number of spurs with one bud were left on each crown and these were not disbudded. As a result,

many of the shoots did not train to the wires but simply hung from the crowns. An idea of the density of the foliage may be obtained from Figs. 101 and 102, which are photographs of the same vine. From the appearance of this vine, the physical impossibility of spraying every cluster even with a trailer can be seen.

Very fortunately, however, certain peculiarities in the life habits of the fungus make the later sprayings of less importance. In the vicinity of Romulus during the past two seasons the following observations have been made. Although about August 1st, or even a little earlier,



Photo. Ang. 31, 1908

FIG. 102.—Same vine as shown in Fig. 101 and from the same position, but with leaves stripped off. Shows average yield of vines. Notice presence of too many short spurs with a leafy shoot, especially at the lower crown. This increases the difficulty of spraying

some berries rot and become covered with the minute black receptacles of the fungus, an examination of these receptacles with the microscope reveals the fact that these bodies do not contain propagative spores for the further dissemination of the fungus; they are for the most part filled up with resting cells, packed with food material, and to all appearances are preparing for a period of rest. Receptacles containing summer or propagative spores can be found occasionally, but there is no doubt

of the fact that the number of spores capable of producing infection is enormously reduced. Undoubtedly the good showing made by experimental plat No. 3, sprayed only four times, can be attributed to this fact, for some Rot was present and rains were of sufficient frequency and duration after July 11th to have allowed for abundant infection and the complete destruction of the crops had spores of the fungus been present in sufficient quantity. Should this peculiarity of the fungus prove to be of constant occurrence, it will be possible to reduce the number of applications of spray actually necessary to control the Rot. This fact explains the common observation that "after the seed gets hard" the Rot stops. The virtue lies not in the hardness of the seed but in the habits of the fungus, for as a matter of fact, berries may and often do rot to a limited extent up to the time of picking.

CONTROL.

The work of control previous to 1908 had shown marked results in favor of spraying and it was felt that certain facts were demonstrated beyond question. These facts are stated below:

(a). When Black Rot is prevalent in a moderate degree spraying will completely control it. This was shown especially in the work of 1907. The plats of that year consisted of one acre each, sprayed with mixtures of different strengths and some unsprayed. Wherever thorough spraying was practiced, 87 to 95 per cent of the total weight of the grapes produced on the plats was graded as firsts and shipped in pony baskets. So effective was the spray that the owner of the vineyard asserted that the grapes might all have been sold as first grade without sorting. On the other hand, the unsprayed plats gave a smaller total yield and only 66 to 70 per cent of this yield was graded as firsts. The total yield on the unsprayed plats averaged about three-fourths of a ton less than that of the sprayed plats. Commercially, the grapes on the unsprayed plats were of little value.

(b). Iron sulfate as a fungicide for controlling Black Rot is of little value, scarcely better than nothing. The work with iron sulfate was carefully and accurately done, yet the total yield of the plat was less than that from plats sprayed with Bordeaux mixture and the spray itself seemed to be ineffective in controlling the Rot, for only 78 per cent of the total grapes picked was graded as firsts.

(c). The different "stickers," such as resin sal soda or fish oil soap, are of no practical value.

(d). Burning the clingers from the wire of the trellis is a means of destroying some of the winter spores. The cost of the work, however,

is too great to make the practice of value to the grower. It is not recommended commercially.

(e). The application of a spray mixture before the appearance of the second set of leaves is of no value. The early applications do not destroy the winter spores which are present, since these spores are enclosed in



FIG. 103.—Hand-spraying grapes on Experimental Plat, June 11, 1908. Note the fog-like spray being produced. 120 pounds pressure; 1-20 inch hole in the nozzle; 50-60 gallons to the acre

sacs which protect them from any spray which may be applied. The first spray should be applied at the time of the appearance of the second or third set of leaves.

(f). The time of applying a spray in relation to the weather conditions is an important consideration. The spores germinate immediately

after a rain. It is essential then that the spray be present at this time to prevent their germination. The mixture should be applied just before a period of rainy weather or as near this time as is practicable.

THE WORK OF 1908.

Although it was felt that the above points were demonstrated beyond question there were still many points unsolved and the work of 1908 was planned in view of solving these problems. Some of them may be stated as follows:

(a). To demonstrate that Black Rot can be controlled commercially in a year most favorable to the development of the Rot.

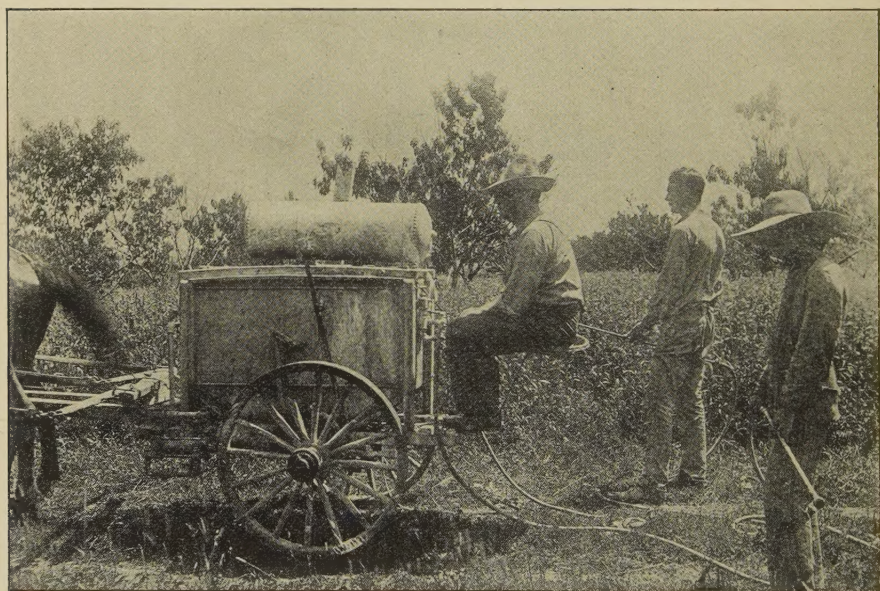


Photo. July 11, 1908

FIG. 104.—Spraying outfit used in experimental work of 1908. Note the trailer attachment for hand spraying.

(b). To determine the minimum strength of mixture and the minimum amount of spray necessary to do this.

(c). To find out the value of cultivation in the control of the disease.

(d). To determine the best time to apply the mixture in relation to the blooming period of the grape and the weather conditions.

In order to get the most serious attack of the Rot, whatever might be the nature of the season, the worst vineyard in the vicinity, so far as the Rot was concerned, was selected and a part of this, amounting

to about seven acres, was chosen for the experiment. This vineyard is situated about $2\frac{1}{2}$ miles east of Romulus and is under the direction of Mr. H. B. Cushman. For several years previous nothing had been picked commercially from the vineyard because the Rot had destroyed the entire crop. During these years sections had been cultivated and pruned but not sprayed. On one of these sections the plat was chosen. It was thought that the Rot would be serious in this vineyard even though the summer should be a dry one. This proved to be true.

The area was divided into six plats, each consisting of seven rows and equal in area to about one acre. Between each two plats was a check row, seven in all, thus making the check rows also equal in area to about one acre. (See map, page 402). It was found that these rows did not make reliable checks since it is impossible, in spraying the adjoining rows, to prevent the spray from blowing on them, and consequently these check rows received more or less of the mixture. In order to check the results of these check rows and thus secure the most reliable check, two solid check plats were chosen, one of them to receive cultivation and the other to be left uncultivated. This plan enabled us to determine the value of spraying and also the value of cultivation as factors in the control of the Rot.

As to the number of applications, at least four seemed necessary, and we found in 1907 that six had given as good results as a greater number. Our plan was to determine the most economical number of applications within this range.

It is important to determine the minimum strength of mixture that will control the disease, since spraying materials are expensive. The work of 1907 had shown that 5-5-50 gave as good results as stronger solutions, consequently there was no need of going above that strength. It was felt, however, that a weaker mixture would be equally effective and therefore it was decided to use 4-4-50 in order to determine whether it was strong enough.

The work of the previous season had shown that the time of the application for effective control depended largely on weather conditions. One plat was planned in view of determining whether this was true and, if so, what were the conditions which determine the time of application. (See plat 4.)

The general plan and map of the work for 1908 is given in Fig. 107. In area each plat is equal to about one acre. The rows (seven to each plat) are nine feet apart and the vines ten feet apart and each row contains sixty-four vines.

The mixtures were made carefully and according to the most reliable directions. The solution was applied with the vineyard sprayer manufactured by the E. C. Brown Co., Rochester, N. Y., and under a pressure of 140 pounds. Great care was taken to apply the mixture thoroughly and evenly. Realizing that many of the failures in spraying



Photo. Aug. 31, 1908

FIG. 105.—*Sprayed.* Small part of vine shown in Fig. 102, from Experimental Plat No. 4

are due to careless applications, the experimenters determined to eliminate this factor. The thoroughness of the application was tested until satisfactory results were secured. A part of a row was sprayed and then an examination made of the foliage and clusters. If unsatisfactory the nozzles and pressure were changed and another trial made. Tests were made in this way until the experimenters were convinced that the application was thorough and yet no mixture was being wasted.

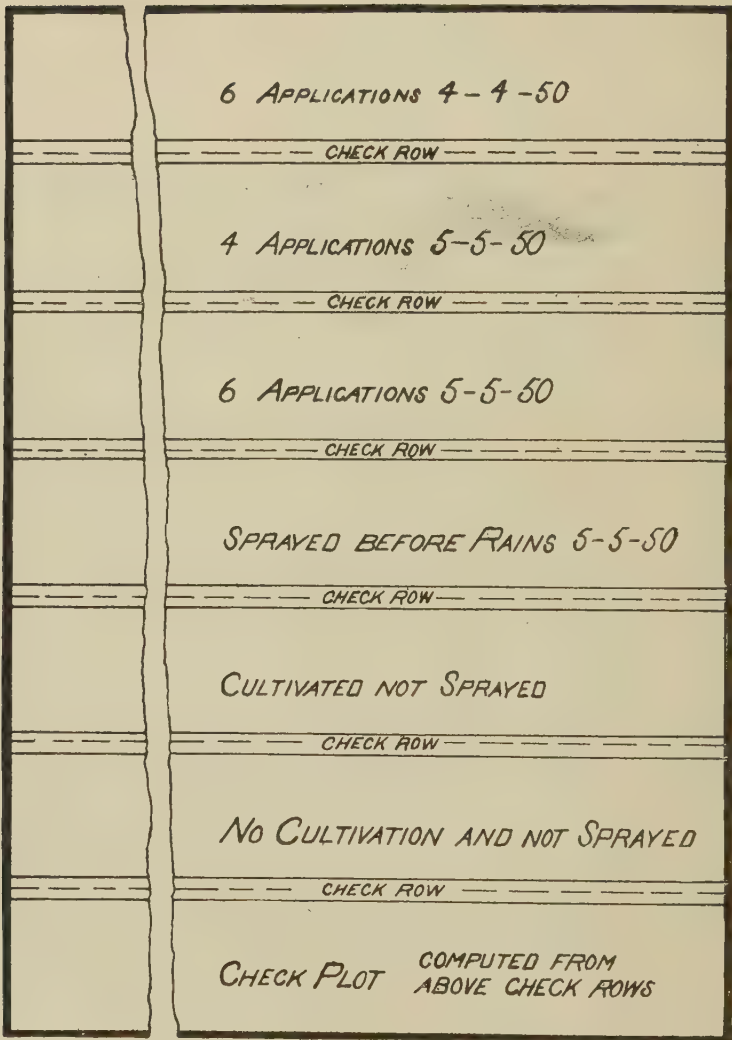
Trailers were used throughout the season. (See Figs. 103 and 104). The trailers were two in number and consisted of twenty feet of three-eighths inch hose, with extension rod three and one-half feet long and a single Mistry Junior nozzle on the end. Repeated trials, which were



Photo. Aug. 31, 1908

FIG. 106.—*Unsprayed. Part of vine in next adjacent row (check) to one shown in Fig. 103*

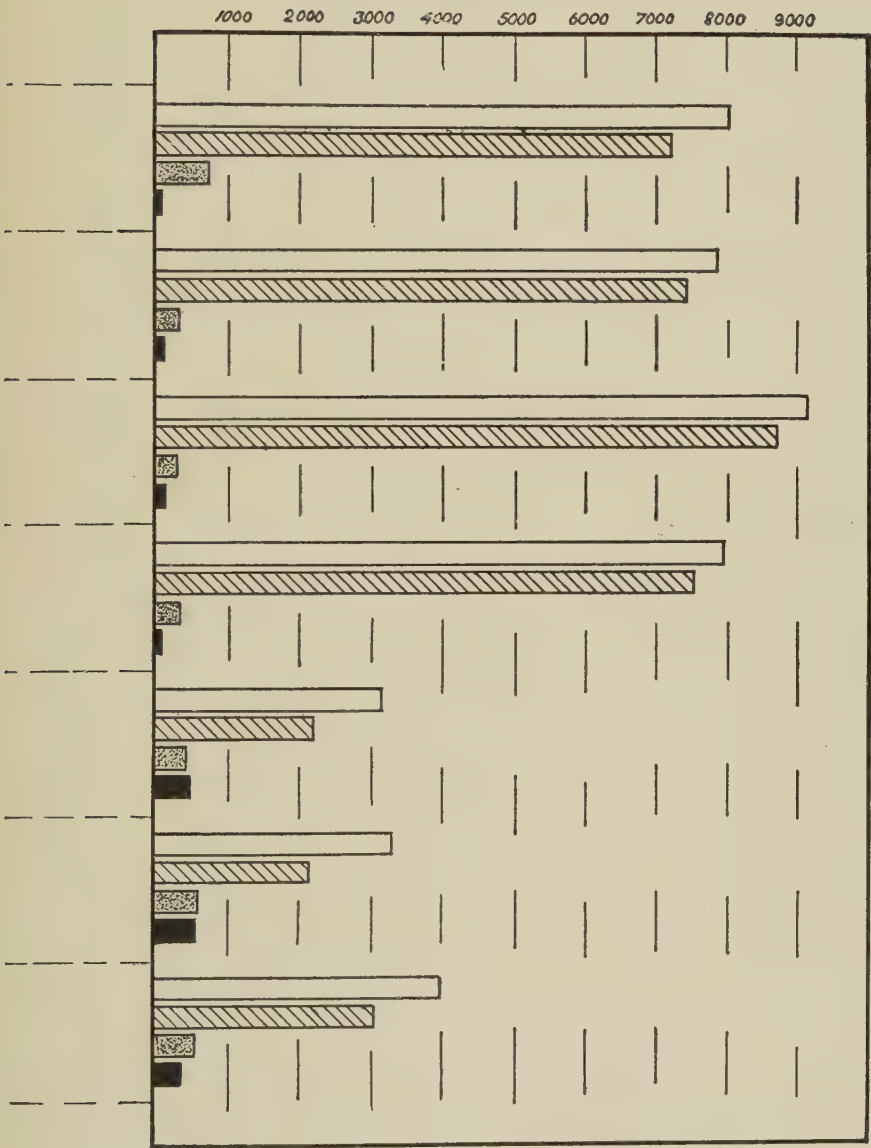
made for the purpose, showed that a trailer of this kind with one nozzle would do as thorough work as a stationary arrangement and two or three nozzles. By the use of the trailers the amount of liquid used was reduced from 80 to 50 gallons per acre—a great saving when considered from a commercial standpoint.



DRAWN BY
LABATCHMELOR

FIG. 107.—Map of experimental plats of 1908. The top is west, to the right, north

YIELD IN POUNDS

DRAWN BY
L. B. BATCHELOR

NET WEIGHT
FIRSTS

WINE
ROTTEN

FIG. 108.—Yields from corresponding plats on opposite page

The number of applications and time of each are as follows:

No. of the Application	Plats 1 and 3	Plat 2	Plat 4
1.....	May 29-30	May 29-30	May 18
2.....	June 11	June 11	May 29
3.....	June 15	June 15	June 11
4.....	June 29	June 29	June 15
5.....	July 11		June 29
6.....	July 23		July 11
7.....			July 23
8.....			Aug. 8

Until the middle of July all applications were made with Bordeaux at the different strengths indicated. (Fig. 107.) After the middle of July, ammoniacal copper carbonate was used. The purpose of this was to avoid discoloring the berries. If Bordeaux had been applied for the last sprayings the fruit would have shown serious discolorations at picking time. Ammoniacal copper carbonate is a colorless spray and by its use late in the season discoloring is avoided. It is probably nearly as effective as Bordeaux, although this is one of the questions which we have not yet worked out and which we expect to try next year.

The plats were picked September 25th to October 10th. All the fruit from each plat was picked, brought to the packing house and weighed. This gave the net (total) weight as recorded in the first column of figures of the table on page 405, or as represented by the first bar for each plat in Fig. 108. The grapes were then sorted into three grades: firsts, wine and rotten. The firsts were extra fine in quality and were packed and shipped in pony baskets. The wine grapes contained the scraggly clusters, the crushed berries and the single berries which had fallen from the bunches. They contained no rotten berries. The rotten berries included the dried, hard berries which were affected with the Rot. The weight of firsts is given in the second column of the table and represented by the second bar in the diagram. (Fig. 108.) The weight of wine is given in the third column of the table and represented by the third bar in the diagram. The weight of rotten berries is represented by the fourth column of the table and shown by the fourth bar in the diagram. The fifth, sixth and seventh columns of figures in the table represent, of the total weight harvested, the per cent of firsts, wine and rotten, respectively.

RESULT OF BLACK ROT EXPERIMENTS IN 1908.

Plat No.	Treatment	Net weight harvested	Weight Firsts	Weight Wine	Weight Rotten	Firsts Per cent	Wine Per cent	Rotten Per cent
		lbs.	lbs.	lbs.	lbs.			
1	Bordeaux 4-4-50, 6 applications.....	8084	7252	742	90	89.7	9.2	1.1
2	Bordeaux 5-5-50, 4 applications.....	7872	7461	305	106	94.8	3.9	1.3
3	Bordeaux 5-5-50, 6 applications.....	9157	8726	306	125	95.3	3.3	1.4
4	Sprayed according to weather conditions....	7997	7588	338	71	94.9	4.2	0.9
5	Cultivated but not sprayed.....	3175	2232	451	492	70.3	14.2	15.5
6	Neither cultivated nor sprayed.....	3334	2169	594	571	65.1	17.8	17.1
7	Seven check rows (1 acre).....	4015	3072	560	383	76.5	14.0	9.5

These figures show the efficiency of spraying from a commercial standpoint. They give the total weight harvested, and the total weight of the first grade as compared with the wine and the rotten berries. From a scientific standpoint, however, they do not show the real value of the spray because a rotten berry will weigh only about one-fourth as much as a perfect berry. The only scientific method of determining how effectively any spray protects the grape from the Rot is to count the perfect and the rotten berries of every cluster. To do this on a large area would be impossible. An attempt was made in the packing house to secure these comparisons. From the grapes picked on the different plats eight crates were taken. The perfect clusters were separated from those containing rotten berries and these clusters counted and weighed. The first four columns in the table on page 406 give these data. Column 5 shows the per cent of imperfect clusters which had only one rotten berry and the last column gives the average number of rotten berries on the imperfect clusters. This number of course would be much smaller if all clusters were included.

It must be remembered, however, that these figures do not represent absolute conditions since many of the berries rotting early in the season have dropped from the clusters.

CLUSTERS.

		PERFECT		IMPERFECT			
		Total by number	Total by weight	Total by number	Total by weight	With 1 rotten berry	Average number rotten berries per cluster
		<i>Per ct.</i>	<i>Per ct.</i>	<i>Per ct.</i>	<i>Per ct.</i>	<i>Per ct.</i>	
1	Bordeaux 4-4-50						
	6 applications.....	54.2	49.6	45.8	50.4	43.2	3.07
2	Bordeaux 5-5-50						
	4 applications.....	54.3	46.	45.7	54.	57.3	3.02
3	Bordeaux 5-5-50						
	6 applications.....	56.8	44.9	43.2	55.1	59.2	2.9
4	Sprayed according to weather conditions.	60.	52.	40.	48.	57.6	2.04
5	Cultivated but not sprayed.....	14.4	18.3	85.6	81.7	9.1	13.06
6	Neither cultivated nor sprayed	6.3	6.3	93.97	93.7	5.2	14.5
7	Seven check rows (1 acre).....	1.5	.8	98.5	99.2	2.9	16.



FIG. 109.—*Sprayed.* Part of a tray of grapes (as they came) from Experimental Plat No. 3



FIG. 110.—*Not sprayed. Part of a tray of grapes (as they came) from Experimental Plat No. 5*

A factor influencing total weight may be mentioned here. At different places in the section vines were missing and the number of such vines differed for the different plats. An attempt was made to correct the error caused by these missing vines, but it was impracticable. The number of such vines on the different plats is as follows:

Plat Number I.....	15
Plat Number II.....	32
Plat Number III.....	21
Plat Number IV.....	39
Plat Number V.....	12
Plat Number VI.....	12
Plat Number VII Check Rows.....	54

In comparing the total yield of the different plats and check rows due consideration should be given to the number of missing vines. A fair average yield per vine was 25 to 30 pounds.

It is interesting to note in this connection that a single check row between two sprayed plats is not an accurate and reliable check. The

influence of the spray which reaches such vines is clearly shown. The seven check rows with fifty-four missing vines gave a greater total yield than check plat V with only twelve missing vines.

CONCLUSIONS

The results of this experiment give additional evidence that the Rot can be controlled commercially by thorough spraying with mixtures properly made and applied. It has not been demonstrated that spraying will control the Rot in exceptionally wet seasons, but it will practically eliminate the Rot in an average year. Consequently, the writers strongly recommend that the grower make a special effort to eliminate the disease every season. There will probably never come a time when spraying will not be necessary, but by this eliminating method the grower may be able materially to reduce the number of applications.

RECOMMENDATIONS.

Plow as early as practicable, making a special effort to turn under all rotten clusters and leaves.

Keep all weeds and grass down.

Instruct workmen to gather any mummies left on the arms and to clean up the brush well.

Do not allow basal sprouts to spread over the ground.

Keep the vines off the ground.

Spray thoroughly. The time of application will depend on the weather. Contrary to common belief, the spray should be applied before rather than after a rain. In general, the time of applications will be as follows:

First, with Bordeaux mixture 5-5-50, at the time when the second or third leaf is showing.

Second, with the same mixture before the blossoms open.

Third, with the same mixture soon after blossoms have fallen.

About two more applications will be necessary and should be made at intervals of ten days to two weeks.

The spray should be applied at a pressure of at least 100 pounds. It is better to use trailers for all the applications, but stationary nozzles may be substituted for the first two sprayings. After the blossoms fall the spray should be directed on the clusters and the tips of the shoots.

OUTLINE OF PLANS FOR 1909

The experiments of the last three years have demonstrated without a doubt that the Rot can be controlled on experimental plats. Some of the growers feel, however, that its control on a commercial vineyard would be more difficult. On the experimental plat the effort is directed primarily to the control of the disease. The greater thoroughness which would be possible on such a plat would not be practicable in a commercial vineyard. The effort of the vineyardist is directed primarily toward money returns and the spraying must be done economically.

In order to meet these arguments against purely experimental work, the College of Agriculture has leased for the year 1909 seventy-five acres of the vineyard known as the Cushman vineyard at Romulus. The plans for the summer are to conduct a large commercial experiment. The necessary expenses on the seventy-five acres will be kept as low as possible, although the vineyard will be maintained in good condition. An effort will be made to market the grapes to the best advantage. The purpose of the entire work is to secure as large net proceeds as possible and leave the vineyard in good condition for next year.

It is also planned to continue experimental work in 1909 on the same vineyard but in a different part of it. A section has been selected from which no grapes have been picked in years. In addition to the Black Rot disease, which is the worst here, the plat selected was prematurely defoliated in 1908 by downy mildew (*Plasmopara viticola*). If we are able to control both of these diseases the contrast between the sprayed and the unsprayed plats will be even more striking than previously.

METEOROLOGICAL DATA TAKEN AT CUSHMAN VINEYARD, ROMULUS, N. Y.,
JUNE 8th TO AUG. 18th, 1908.

Date	TEMPERATURE		PRECIPITATION			Direction of prevailing wind	Charac- ter of day*	Miscellaneous
	Max.	Min.	Time of beginning	Time of ending	Amount			
June								
8	94	56	—	—	—	S	.1	
9	91	66	4	6	.73	W	.4	slight shower at 3.30.
10	75	54	—	—	—	NW-NE	.4	cloudy in a. m.
11	70	48	—	—	—	NE-E	.4	very heavy dew.
12	71	44	—	—	—	E-SE	.1	
13	86	50	—	—	—	S	.1	
14	92	63	4 p. m.	5 p. m.	1.67	SW-W	1.	
15	69	52	—	—	—	NW	.1	windy.
16	65	51	—	—	—	NE	.1	heavy dew.
17	71	44	—	—	—	SE-S	.2	threatening in p. m.
18	84	50	—	—	—	S	.1	threatening in a. m.
19	94	62	—	—	—	W-NW	.1	
20	90	62	—	—	—	N	.1	
21	86	62	—	—	—	N	.1	
22	87	62	night	a. m.	1.25	N	.1	very light wind.
23	88	68	night	a. m.	.25	N	.4	very light wind.
24	80	68	—	—	T†	SW-W	.4	heavy dew, no wind.
25	84	57	—	—	—	W-NW	.3	threatening in a. m.
26	76	50	—	—	—	N-NE	.1	
27								
28								
29			early in	a. m.	.15	SW-W	.3	
30	81	58	—	—	—	NW		
July								
1	87	56	—	—	—	N	.1	
2	86	60	—	—	—	NW-SE	.3	
3	86	62	—	—	—	NE-SE	.1	
4	80	66	4 p. m.	—	T	SE-SW	.3	
5	88	61	—	—	—	SW-W	.1	
6			—	—	—	NW	.1	
7	95	65	4 p. m.	8 p. m.	.19	SE	.4	
8	79	55	—	—	—	W-NW	.5	cloudy; windy.
9	80	50	—	—	—	NW	.1	
10	98	53	—	—	—	E-SE	.1	
11	95	58	—	—	—	S-SW	.1	
12	92	63	12	6 p. m.	1.05	SE	.5	partly cloudy.
13	80	61	night	night	.37	SW-W	.5	light showers.
14	88	64	8 and 1	—	—	W-NW	.7	windy.
15	74	55	—	—	—	NW	.2	
16	75	55	—	—	—	SE-S	.1	
17	71	51	10 a. m.	6 p. m.	.5	SE-S	.8	
18	88	66	8 a. m.	12 m.	.3	SE-S	.6	
19	82	63	—	—	—	W-NW	.4	showers.
20	81	57	—	—	—	W	.6	
21	79	57	7 a. m.	night	1.57	W	1.	wind light.
22	88	57	—	—	—	W	.4	wind light.
23	82	56	—	—	—	N	.3	
24	83	60	8 p. m.	night	.47	N	.1	
25	79	64	—	—	—	N	.1	
26	84	60	—	—	—	E	.1	
27	87	56	—	—	—	E	.1	
28	87	60	—	—	—	S	.1	
29	91	61	—	—	—	W	.1	
30	91	63	—	—	—	NW	.1	
31	91	60	—	—	—			
Aug.								
1	75	55	—	—	—	—	.2	
2	—	51	—	—	—	—	.1	
3	—	—	—	—	—	—	.1	
4	95	55	—	—	—	SW-N	.4	
5	88	60	night	10 a. m.	.5	S	.8	
6	84	58	—	—	—	SW	.3	heavy dew.
7	79	60	night	night	.6	SW	1.	rainy all day.
8	79	58	—	—	—	N	.4	heavy dew.
9	79	55	—	—	—	N	.2	
10	74	64	—	—	—			

METEOROLOGICAL DATA—Continued.

Date	TEMPERATURE		PRECIPITATION			Direction of prevailing wind	Character of day*	Miscellaneous
	Max.	Min.	Time of beginning	Time of ending	Amount			
Aug.								
11	81	62	2 p. m.	3 p. m.	T	W	.5	high wind. showers.
12	81	58	1 p. m.	2 p. m.	T	S	.5	
13	88	68	1 and 5 p.m.	2 and 6 p.m.	1.	SW-NE	.7	
14	86	60	—	—	—	W	.2	
15	82	62	—	—	—	NW	.1	
16			—	—	—	S	.1	
17	88	51	night	8 a. m.	.47	SW		
18	81	59	—	—	—	NW	.1	

* Character of the day, .1-.3 clear; .4-.7 fair or partly cloudy; .8-1. cloudy.

† Trace

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